A (condensed)Modern History of Biometric Testing in the US

Dr. James L. Wayman

jlwayman@aol.com

Our Focus

San José State UNIVERSITY

- History of third-party testing of automated human recognition technologies in the U.S.
- An incomplete survey
- Goal: Stimulate the study of our historical roots

Some Pre-History

- J. Sherme and J. Holmes, “An experiment concerning the recognition of voices” , Language and Speech, (2), 1959
- L. Kersta, “Voiceprint Identification”, Nature (196), 1962
  - 8 high school girls with one week training
  - 2000 identification attempts on one or more words
  - Performance varied by word
- A.J. Mauceri, “Feasibility Study of Personal Identification by Signature Verification”, North American Aviation, SID65-24, 19 January 1965
  - 226 of 250 signatures correctly verified
- W.W. Bledsoe, “Man Machine Facial Recognition: Report on a Large-scale Experiment”, Panoramic Research, Inc. (1966)
  - 2,000 photos, 40k comparisons

Michigan State University

- O. Tosi, et al, “Experiment on Voice Identification”, JASA (51)6, 1972, pp 2030-2043
  - A test of voiceprint approach of L. Kersta, “Voiceprint Identification”, Nature (196), pp 1253-1257, 1962
  - Semi-automated: speech spectograms shown to trained examiners
  - “Intraspeaker variability”
  - “Interspeaker variability” .. stems mainly from anatomical differences in vocal tracts and learned differences
  - “Closed/Open” tests
  - “Contemporary/Non-contemporary”

NIST

- J. Wegstein, "Automated Fingerprint Identification", NBS Tech. Note 538, Aug. 1970
- Open and closed set tests

		XIV																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
XIII	1	128	46	8	11	23	8	32	30	13	18	22	42	22	6	53	54	22	19	32	12
	2	55	80	8	12	11	12	28	29	6	12	17	25	18	27	40	34	10	8	8	10
	3	9	11	75	35	16	20	19	9	19	30	23	9	14	13	16	18	36	25	14	17
	4	6	1	19	63	14	16	2	4	11	21	22	23	15	13	17	7	22	18	9	26
	5	11	13	13	27	37	28	14	22	20	40	25	13	16	14	24	20	46	36	29	22

Figure 1. Score Matrix

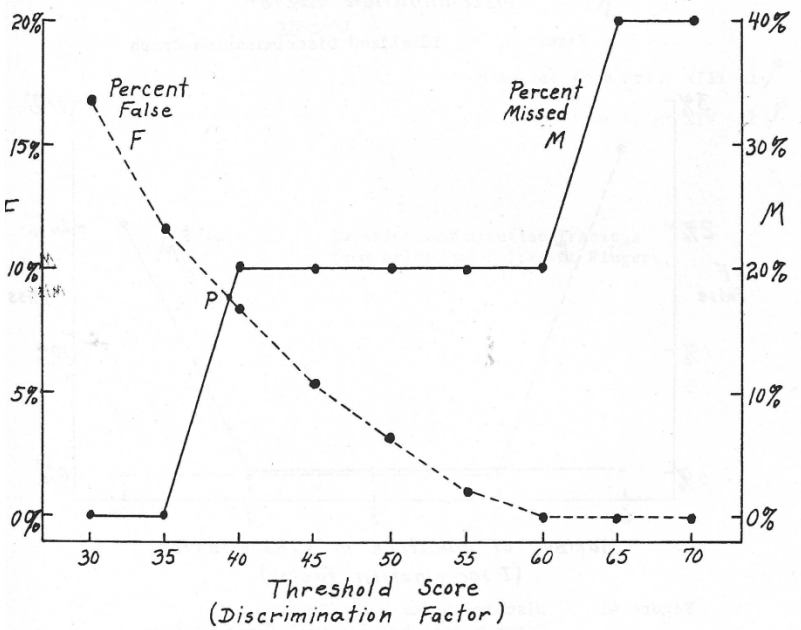


Figure 2. Discrimination Graph Corresponding to Figure 1.

FIPS PUB 48 (1977)

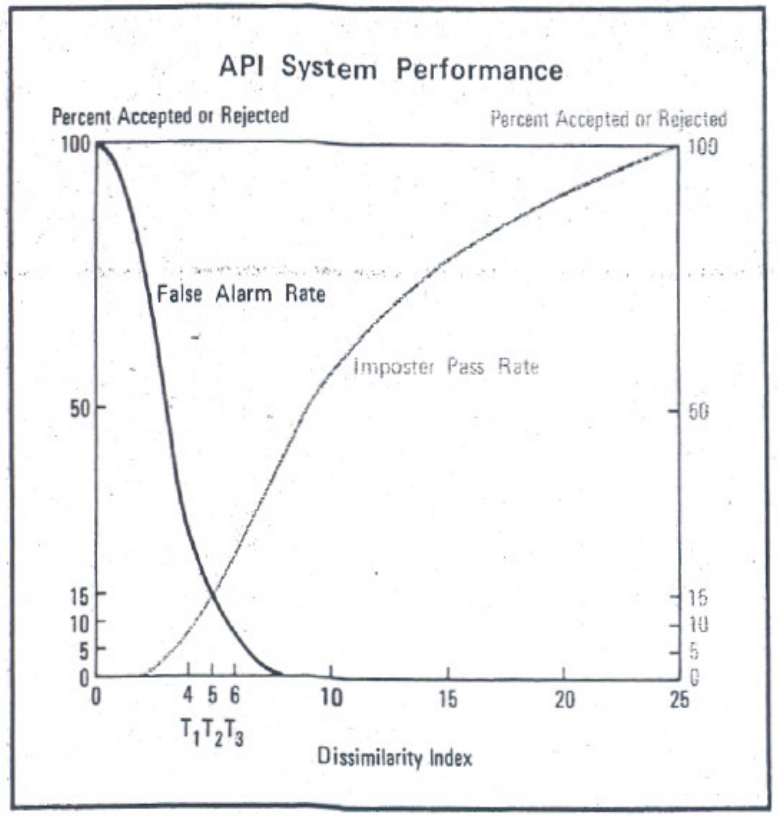
"Guidelines on Evaluation of Techniques for Automated Personal Identification"

- Type I = false alarm rate (FAR)
- Type II = impostor pass rate (IPR)
- "Effects of allowing multiple attempts"
- "Combining personal identification methods" using AND/ OR

- Face Signature
- Hand geometry
- Fingerprint
- Voice print
- Ear Features
- Dental characteristics
- Footprints
- Retina

SRI (Lost Documentation)

- D.E. Raphael and J.R. Young, “Automated Personal Identification”, 1974
- False alarm rate
- Impostor pass rate
- “Resistance to deceit”
- “Combining of personal identification methods”



Mitre

Kibbler, G.O.T.H, "Evaluation of the Identimat 2000 Hand Geometry Identifier", Mitre Corp., Oct., 1972

a. In excess of 14% of personnel tested were consistently rejected when they should have been accepted.

b. The acceptance rate did not differ significantly between experienced and inexperienced users of the system; therefore, no improvement in performance can be expected with training.

c. To approach a 90% correct acceptance rate on a 3-try basis would involve loosening tolerances to the point where a false acceptance rate of 6% would be expected for the test population at Robins AFB.

d. The construction of hand silhouettes for intrusion is a relatively simple matter.

Haberman and Fejfar(1976)

- Handwriting and speech
- 209 volunteers
- 2600 trials for each technology
- 100,000 cross comparisons segregated by gender
- Variation of Type I errors by person
- Male error rates lower

Fejfar and Myers (1977)

	Speaker		Handwriting		Fingerprint	
	FRR	FAR	FRR	FAR	FRR	FAR
Lab	0.2	4.4	3.2	1.7	4.6	2.2
Field	1.1	3.3	1.9	5.6	6.5	2.3
Time	6.2 sec		13.5		8.9	

Fejfar (1978)

	S&H	H&F	F&S	S&H&F
FRR	3.0	8.4	7.6	9.5
FAR	0.18	0.13	0.08	0.0043
Ver Time	19.7	22.4	15.1	28.6
Total Time	32.0	34.7	27.4	40.9

Fejfar (1978)

	S||H	H||F	F||S	S||H||F
FRR	0.02	0.12	0.07	0.0014
FAR	8.9	7.9	5.6	11.2
Ver Time	10.4	12.8	8.2	10.7
Total Time	22.7	25.1	20.5	23.0

1980s Pilot Projects

San José State UNIVERSITY

Army Tests ATMs for Paying Salaries

Special to GCN

Three thousand Army trainees at Fort Harrison, Ind., are now receiving their monthly pay from an automated teller machine (ATM) that identifies users by their handprints.

The program is testing the new ATM for its convenience, cost efficiency and general security. The test, which began July 31, is part of a government push to streamline its payment and collection systems through state-of-the-art technology. It is cosponsored by the Army Finance and Accounting Center and the Bureau of Government Financial Operations (GFO) in the Treasury Department.

The test is said to be the first to use hand geometry devices in conjunction with ATMs. The device was developed by Stellar Systems Inc., San Jose, Calif., and is bing tested with NCR Corp. 5070 ATMs. It is most frequently used to control access to secure areas, and has even been used in a university setting for student access to food service.

The Army trainees were chosen because their moderate pay levels and their brief residency on the base often discourage them from opening bank accounts. Without bank accounts, they must cash their entire monthly paycheck, requiring time off from training during banking hours and resulting in inefficient money management and costly fees to convert cash into more secure forms, such as traveler's checks and money orders.

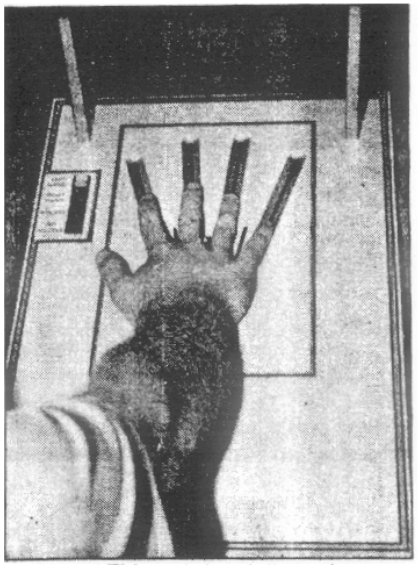
Under the current disbursement process, the only alternative to payment by check is payment by direct deposit (the Army calls its program SURE-PAY), which uses electronic funds transfer systems to deposit paychecks automatically into checking or savings accounts.

The Treasury's Office of External Affairs estimates the government spends 24 cents to prepare and mail each check, compared to 3 cents for the direct deposit alternative. Of the 50 million persons regularly receiving government payments, 38 percent used direct deposit in 1983.

An Army spokesman at Fort Harrison said "the ultimate goal is 100 percent use of SURE-PAY." He stressed that the handprint ATM is not, nor will be, the major program for paying personnel.

Accommodating "unbanked" personnel such as Army trainees and reducing the cost and time consumption to the government and its employees are major reasons behind the test. According to Capt. John R. Herko, project officer for the Army, "providing security and "round-the-clock accessibility of funds through ATMs and saving trainees money" are the main objectives of testing alternative payment mechanisms.

The Fort Harrison ATM uses a biometric recognition device — in this case, hand geometry — to read the dimensions of an individual's hand. The hand is placed over several indented finger slots, with a sensing pin fitting between the middle and ring fingers. A series of photodetectors beneath the hand plate measures the length of the fingers and the translucency of the webbing between the fingers, matching the measurement of a previously recorded handprint.



New ATM reads hand dimensions.

In principle, the handprint is similar to the personal identification number used by comercial banks to access personal accounts. However, hand geometry reduces security risks, such as the loss or theft of access cards and identification numbers, GFO said.

After a week in operation at Fort Harrison, comments about the system centered on its easy operation and its 24-hour accessibility, according to the Army, Rather than keeping a month's pay in the bunkhouse or giving it to his first sergeant, a soldier can withdraw $20 and "know where the rest is," a spokesman commented.

Sandia Test Program (1983 – ~2000)

"Tighter security requirements to combat the threat of terrorism, and today's capabilities of transferring large amounts of information and funds at electronic speeds further increases the need for personal identity verification."
-- Russell L Maxwell, "The Status Of Personnel Identity Verifiers", 1985

Sandia Test Program

Transaction time in seconds

	SNL'84	SNL'87	SNL'91	NPL2000
Fingerprint	xx	9.8	6.6	8
Hand	xx	4.4	5	10
Eye	7	7.5	7	12
Voice	20	8.8	19.5	12

The Cost of Biometrics (1984)

- Voice: $7,000
- Retina: $50,000
- Fingerprint: $10,000
- Finger Length: $7,000

-- R.L. Maxwell, "General Comparison of Six Different Personnel Identity Verifiers", Sandia National Laboratory, June 20, 1984

Sandia 1991

Holmes, Wright, and Maxwell, “A Performance Evaluation of Biometric Identification Devices”, SAND91-0276 l UC–906

- Signature
- Retina
- Hand
- Voice (2)

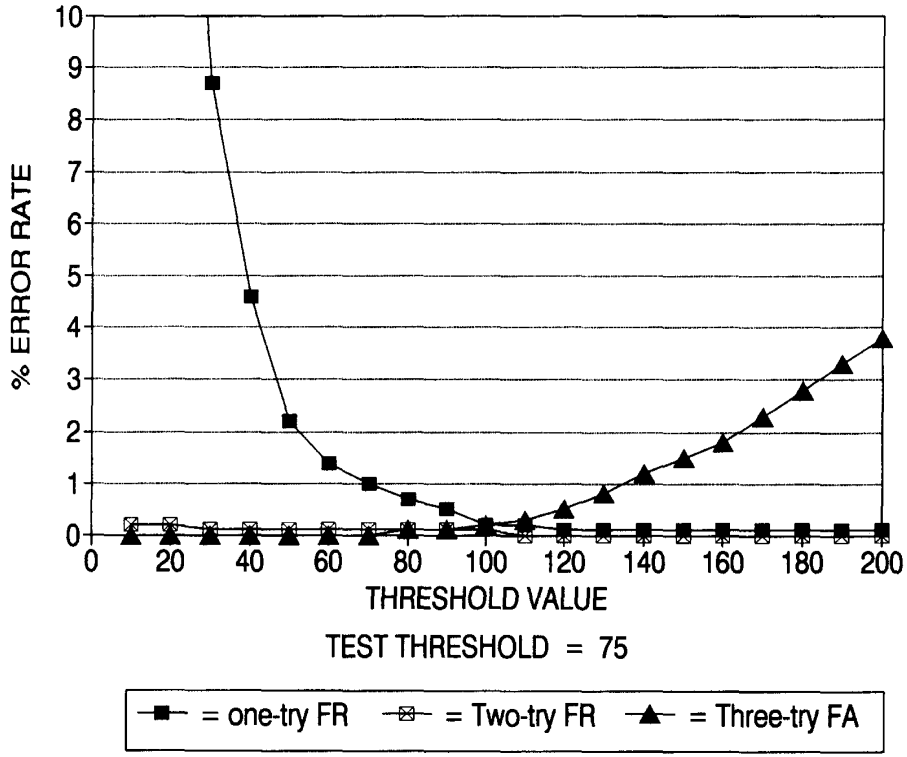


Figure 5. Recognition Systems Hand Geometry

Naval Postgraduate School (1984-1994)

Prof. Gary Poock, Dept. of Operations Analysis

Ph.D. in human factors

- Access control laboratory
- Retina
  - SCIF access control
- Hand Geometry
- Signature

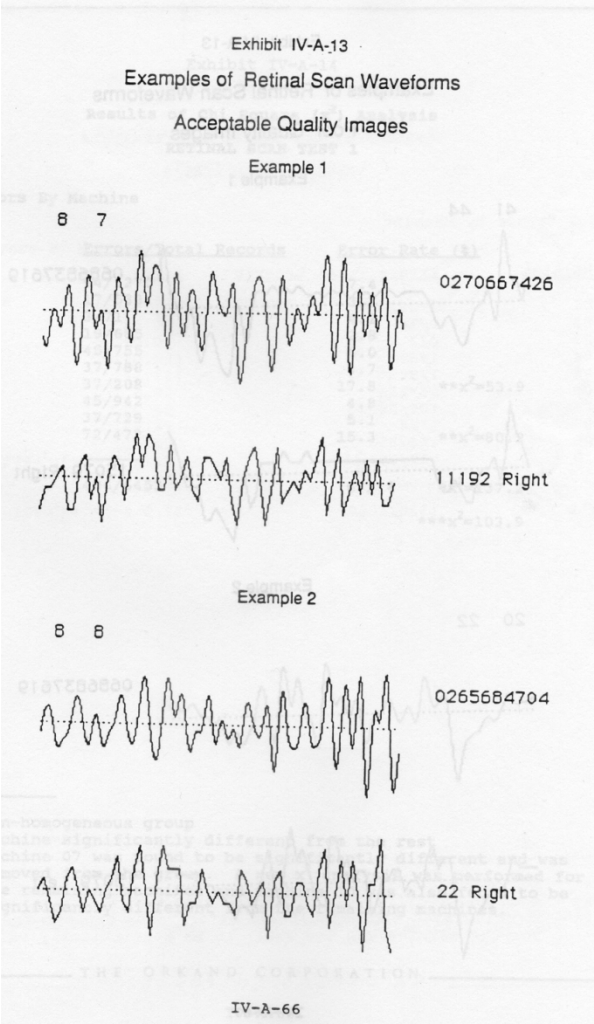
Department of Transportation (1990)

- Commercial Driver Licensing
- CA-DMV/Orkand
  - Fingerprint
  - Retina

Accuracy Rate

Evaluation Criteria	Test Results Fingerprints	Retinal Scan
Enrollment: Correct Issuance (Test 1)	98.46%	96.59%
Enrollment: Correct Denial (Test 2)	92.01%	69.08%
Verification: Correct Denial (Test 3)	100.00%	100.00%
Verification: Correct Issuance (Test 4)	92.41%	84.20%

Retinal Scan



1990s

- Sandia (1991, 1993, 1996)
- NIST SRE (1996-present)
- ARL FERET (1993 -1997)
- Industry efforts
  - Commercial Biometric Developers Consortium (1997)
  - John Seidlarz's iris test for Defense Nuclear Agency (1996)
  - IBG

US National Biometric Test Center (1997-2000)

www.engr.sjsu.edu/biometrics/nbtccw.pdf

- AFIS
  - ROC analysis
  - Bin error v. penetration rates
- Large-scale operational test
  - Hand geometry (INSPASS)

Army Biometric Fusion Center (2000 – 2005)

San José State UNIVERSITY

- Biometrics on weapon systems
- "Enterprise" access control
- "Quick looks"
  - Completed 12 biometric device field quick looks - 9 fingerprint, 2 iris, 1 hand geometry (7 Army, 2 Air Force, 1 Navy, 1 Marine Corps, and 1 DoD Agency)
  - Completed 56 assessments of commercial biometric products - 25 fingerprint, 2 iris, 2 hand geometry, 1 signature verification, 2 speaker recognition, 8 facial recognition, 14 middleware products, 1 retina, 1 web portal

NIST IAD (2003 – present)

You are here ☒

http://biometrics.nist.gov/